PATENT SPECIFICATION 752,268

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COMPLETE SPECIFICATION.

Induction Heating of Metals.

We, T. I. (GROUP SERVICES) LIMITED, a British Company, of Rocky Lane, Aston, Birmingham 6, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :—

This invention relates to the induction heating of metals.

For induction heating it is common practice to use high frequency current, to produce which a high frequency alternator is necessary.

A frequency of 10,000 cycles per second is common and for special purposes still higher frequencies are used.

Recently there has been some development of induction heating with current at the ordinary mains or standard frequency of 50 cycles per second. This eliminates the necessity for high frequency generators but the efficiency is lower.

In induction heating of ferrous metals the heating effect up to the Curie point is partly by hysteresis and partly by eddy currents, above that point it is by eddy currents, whilst with non-ferrous metals heating it is by eddy currents.

One of the objects of our invention is to improve the efficiency of induction heating with alternating current of normal mains or standard frequency, i.e. 50 cycles per second.

According to our invention, induction heating of metals is effected by subjecting the metal to the field of a coil through which is passed alternating current of normal mains frequency incorporating a substantial proportion of harmonics of that frequency.

Current having the required characteristics can be produced by increasing the induction density in the iron core of a transformer employed to step down the mains voltage. The transformer is designed with a core of lower cross-section than normal, i.e. the core is of such cross-sectional area as will distort considerably the waveform in the secondary produced from that pure normal mains frequency current in the primary for which the windings and cooling provisions are designed. Increase of the induction density produces in the secondary voltage from the transformer harmonic frequencies which are superimposed on the fundamental frequency.

The harmonics which most frequently appear are the third, fifth, and seventh of 150, 250 and 350 cycles respectively.

When such current is employed for induction heating the rate of heating is accelerated and it is possible to reach higher temperatures than with current which is wholly of standard 50 cycle wave form.

The improvement in efficiency depends on the percentage of the harmonics and particularly the higher harmonics and is greater when applied to the heating of non-ferrous metals where the heating is effected by eddy currents.

Where high temperatures have to be produced it may be desirable to employ high frequency current as well as current at mains frequency with harmonics. Both supplies can be fed to the same coil, the heating over the lower temperature range being effected mainly by the mains frequency current and the heating over the upper range being supplemented by the high frequency current.

What we claim is :—

1. A method of heating metal by electrical induction in which the metal is subjected to the field of a coil through which is passed alternating current of normal mains frequency incorporating a substantial proportion of harmonics of that frequency.

2. A method of heating metal by electrical induction according to Claim 1, in which the predominating harmonics are the third, fifth and seventh.

[*Price* 3*s.* 0*d.*]

Price 3s. 6d.

3. A method of heating metal by electrical induction according to Claim 1, in which the coil is also simultaneously supplied with high frequency current from a separate source.

4. Apparatus for carrying out the method of Claim 1 or Claim 2, comprising a transformer of which the core is of such cross-sectional area as will distort considerably the waveform in the secondary produced from that pure normal mains frequency current in the primary for which the windings and cooling provisions are designed.

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PROVISIONAL SPECIFICATION.

Induction Heating of Metals.

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This invention relates to the induction heating of metals.

For induction heating it is common practice to use high frequency current to produce which a high frequency alternator is necessary.

A frequency of 10,000 cycles per second is common and for special purposes still higher frequencies are used.

Recently there has been some development of induction heating with current at the ordinary mains frequency of 50 cycles per second. This eliminates the necessity for high frequency generators but the efficiency is lower.

In induction heating of ferrous metals the heating effect up to the Curie point is partly by hysteresis and above that point by eddy currents while with non-ferrous metals the heating is practically entirely by eddy currents, and the lower the frequency the less is the production of eddy currents in the article heated.

One of the objects of our invention is to improve the efficiency of induction heating with alternating current of standard frequency.

According to our invention induction heating of metals is effected with alternating current of standard frequency incorporating a substantial percentage of the higher harmonics of that frequency.

Current having the required characteristics can be produced by increasing the induction density in the iron core of a transformer employed to step down the mains voltage. Increase of the induction density produces in the secondary voltage from the transformer harmonic frequencies which are superimposed on the fundamental frequency.

The harmonics which most frequently appear are the third, fifth, and seventh of 150, 250 and 350 cycles respectively.

When such current is employed for induction heating the rate of heating is accelerated and it is possible to reach higher temperatures than with current which is wholly of standard 50 cycle wave form.

The improvement in efficiency depends on the percentage of the harmonics and particularly the higher harmonics and is greater when applied to the heating of non-ferrous metals where the heating is effected by eddy currents.

Where high temperatures have to be produced it may be desirable to employ high frequency current as well as current at mains frequency with harmonics. Both supplies can be fed to the same coil, the heating over the lower temperature range being effected mainly by the mains frequency current and the heating over the upper range being continued by the high frequency current.

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